Project Title: MTBE Adsorption/Oxidation
Investigator: Scott Huling
Collaborators: University of Arizona, Department of Chemical and Environmental Engineering, Tucson, AZ; Dr. S. Hwang (NRC Post-Doc) at EPA-GWERD.

Project Overview/Results: A Fenton-driven mechanism for regenerating spent granular activated carbon (GAC) was recently proposed and tested [1,2]. This technology involves the combined use of two reliable and well established treatment technologies, adsorption on granular activated carbon (GAC) and Fenton oxidation. Environmental contaminants are immobilized and concentrated on the GAC during carbon adsorption treatment, and subsequently transformed by the Fenton mechanism generated hydroxyl radical (·OH) and superoxide radical ($\cdot O_2^-$) during oxidative treatment. The objective of the treatment process is to transform the contaminants into less toxic byproducts, re-establish the sorptive capacity of the carbon for the target chemicals, increase the useful life of the GAC, and reduce costs for GAC regeneration and water or air treatment. This project involves three main components, (1) test the applicability of the adsorption/oxidation treatment technology to MTBE, (2) optimize the treatment process and (3) investigating fundamental mechanisms with the treatment process.

Two regeneration cycles of MTBE-spent activated carbon under aggressive oxidant conditions was accomplished without significant deterioration of the physical structure and adsorption capacity of the carbon (91 % regeneration) [3]. The reaction byproducts from MTBE oxidation were also degraded and did not accumulate significantly on the GAC. Multiple treatments of GAC without sorbed contaminants underwent chemical and physical changes that reduced the sorptive capacity of the GAC [4]. Protection of the activated carbon during oxidative treatment can be provided by the adsorbate due to fewer reactions between ·OH and carbon surfaces relative to reactions between ·OH and the target adsorbate. Process optimization involving pH, Fe, H_2O_2, hydraulic loading, and reductants are also under investigation.

Other/Future Research: A pilot-scale study is underway at the U. of AZ (Drs. R.G. Arnold, W.Ela) investigating the feasibility of the proposed technology at field-scale involving PCE (Cooperative Agreement . Additional research is currently planned at the Kerr Research Center by Drs. Hwang and Huling involving Fenton oxidation. The focus will involve both fundamental mechanisms and field applications of the adsorption/oxidation technology and in-situ Fenton oxidation.

References:

[1] Huling, S.G.; Arnold, R.G.; Sierka, R.A.; Jones, P.K.; Fine, D. *J. Environ. Engin.* 2000, 126, (7), 595-600.

[2] Kommineni, S.; Ela, W.P.; Arnold, R.G.; Huling, S.G.; Hester, B.J.; Betterton, E.A. 2002**.** *J. Environ. Eng.* Sci.20(4)361-373.

[3] Huling, S.G., P.K. Jones, W.P. Ela, and R.G. Arnold. (Submitted, December, 2003.) “Fenton-Driven Chemical Regeneration of MTBE-Spent Granular Activated Carbon”. *J. Environ. Eng.*

[4] Huling, S.G., P.K. Jones, W.P. Ela, and R.G. Arnold. (Submitted, August 2003.) “Repeated Reductive and Oxidative Treatments on Granular Activated Carbon”. *J. Environ. Eng.*